**STATE OF ALASKA DOT&PF**

# MATERIAL SITE INVENTORY STATUS & INSPECTION REPORTS

# CENTRAL REGION

# KENAI SPUR HIGHWAY & VICINITY

## SECONDARY ROUTE NO. 490
**FROM MP 13 OF THE KENAI SPUR HIGHWAY TO MP 39**

**Federal Project No. STP000S(823)**
**AKSAS Project No. 76149**

**ALASKA DEPARTMENT OF TRANSPORTATION**
**& PUBLIC FACILITIES**
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**July, 2015**

## STATEWIDE MATERIAL SITE INVENTORY

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The discussions of material site conditions presented in these reports has been based on the pertinent information listed herein and are intended to be used for planning purposes only. The information contained should be verified prior to use for design or construction purposes. To be sure of comprehensiveness, please check with State of Alaska DOT&PF materials staff for updated information. Every reasonable effort has been made to assure the accuracy of the maps and associated data. However, the State of Alaska DOT&PF makes no warranty, representation or guaranty as to the content, sequence, accuracy, timeliness or completeness of any of the data provided herein. The State of Alaska DOT&PF explicitly disclaims any representations and warranties, including, without limitation, the implied warranties of merchantability and fitness for a particular purpose. The State of Alaska shall assume no liability for any errors, omissions, or inaccuracies in the information provided regardless of how caused. The State of Alaska DOT&PF shall assume no liability for any decisions made or actions taken or not taken by the user of the applications in reliance upon any information or data furnished hereunder.

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## KENAI SPUR HIGHWAY
## & VICINITY

## SECONDARY ROUTE NO. 490

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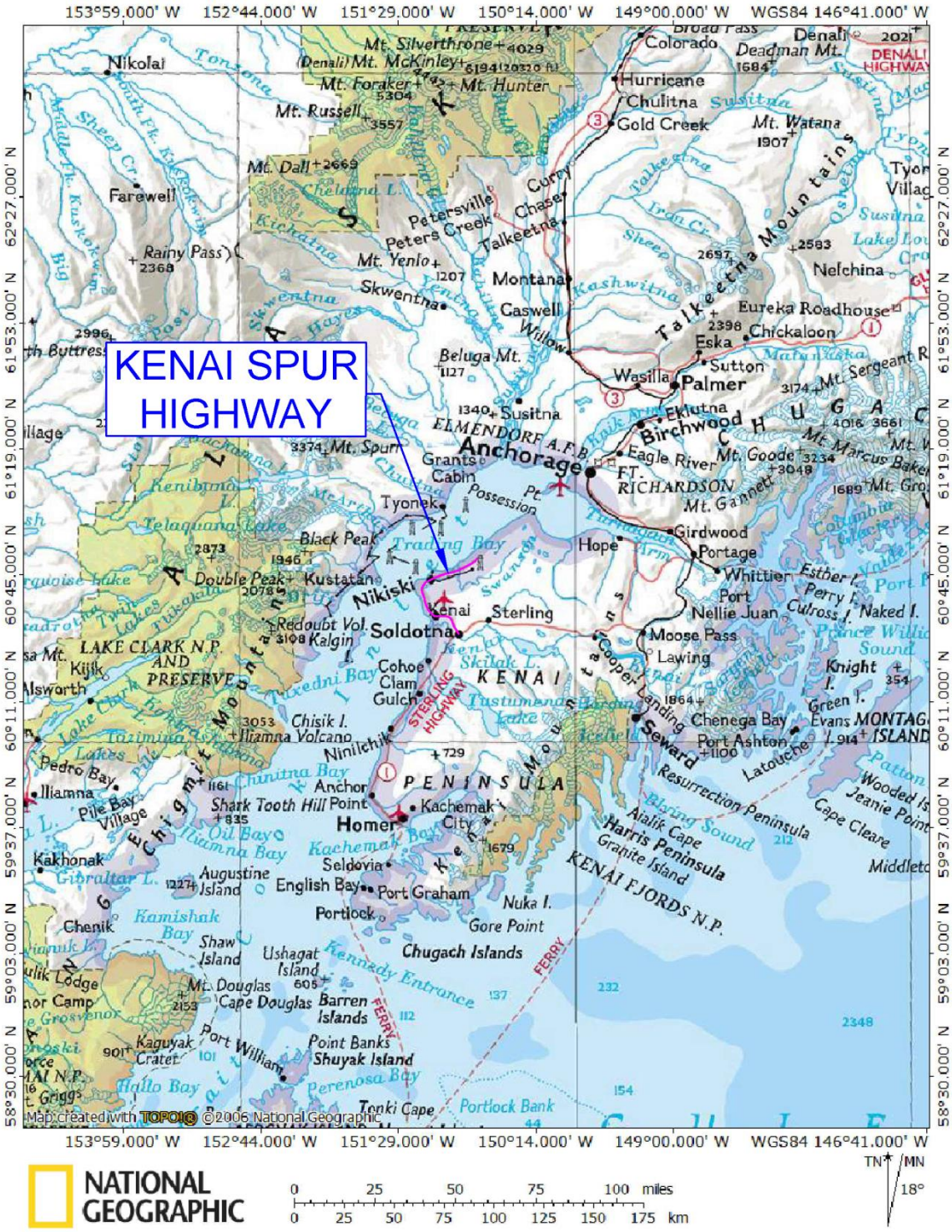
## VICINITY MAP



# STATE OF ALASKA DOT&PF
# STATEWIDE MATERIAL SITE INVENTORY

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## KENAI SPUR HIGHWAY
## & VICINITY
## SECONDARY ROUTE NO. 490

### 1.0 MATERIAL SITE NUMBERING

Alaska Department of Transportation and Public Facilities (DOT&PF) material site numbers for Kenai Spur Highway and Vicinity were assigned using the following format.

Using secondary route system coding, i.e. 490-001-1:

- The first three digits represent the Secondary Federal Aid Route Number, for Kenai Spur Highway this number is 490.
- The 4th, 5th and 6th digits are the assigned site number.
- The last digit is the region in which the site is located. For the Central Region the number is 1.

## 2.0 MATERIAL SITE CLASSIFICATION

Material site classification and status was determined during the inventory for the sites along Kenai Spur Highway and Vicinity. Classification and status is current as of the date on the cover sheets of the Inspection and Status Reports, but both may have changed since that date. Therefore the reader is directed to DOT&PF ROW Central Region Material Site Inventory or Central Region Materials and ROW Sections for updates and current information. Criteria for determining classification and status for material sites along Kenai Spur Road are outlined below.

### CLASSIFICATION

- ACTIVE – Four sites were classified ACTIVE on the Kenai Spur Highway. There were apparently two DOT&PF sites that were still being used to obtain material.
- INACTIVE – Sites (with MS numbers) that DOT&PF apparently no longer has any interest in and/or are no longer available for extracting material. This may be due to relinquishment of the site by DOT&PF or closure by agencies. Twenty-six sites were classified INACTIVE on the Kenai Spur Highway.

### STATUS

- OPEN – Apparently there is one OPEN site on the Kenai Spur Highway, the Bernice Lake Maintenance Site at MP 22.5 (MS 490-585-1).
- CLOSED – Includes sites in which permits have expired, been terminated, or otherwise closed and no further consideration of the site is planned. There were 23 sites classified as CLOSED on the Kenai Spur Highway.
- REMOVED – Some sites may not be material sites but sites for buildings and other infrastructure. The North Kenai Maintenance Station (MS 490-004-1) had never been intended as a material site and should be removed from the inventory.
- STATUS UNKNOWN – Sites that have expired KPB, DNR, or BLM contracts but the case file abstract indicates they are not closed. One site was classified as ACTIVE-UNKNOWN due to unresolved ROW issues (MS 490-019-1). Two INACTIVE sites were classified as INACTIVE-UNKNOWN as they appear to have active BLM right-of-ways, but they are shown on the Kenai Parcel Viewer as being private property.
- UNDEVELOPED – Active sites that are apparently available for mining but have never been developed. There are apparently two undeveloped sites along the Kenai Spur Highway (MS 490-014-1 & MS 490-022-1). Both of these sites may need KPB conditional use permits.

## 3.0 GEOLOGIC SETTING

The following information is general in nature and is intended to provide those who are unfamiliar with the area with a general description of the geology, and how it relates to material sites. This information is not intended to be complete. More detailed investigations should be performed before decisions are made on individual material sites.

### 3.1 Location and History

The inventory area lies along the Kenai Spur Highway between Milepost (MP) 13 on the west edge of the City of Kenai and MP 39 at Bay Beach Road in the Captain Cook State Recreation Area. It also includes all of the area generally designated as North Kenai, north of the City Limits of Kenai, including Nikiski and Salamatof.

In 1786 the Russians built Fort Nikolaevskaia on the site of modern Kenai, being the first European settlement on the Alaskan mainland. Hostilities surfaced between the natives and settlers in 1797, culminating in an incident in which the Dena'ina attacked Fort St. Nicholas, later dubbed the battle of Kenai. In 1869, after the Alaska Purchase, the United States Army established a post called Fort Kenay but it was soon abandoned.

The establishment of shipping companies in the early 1900s broadened Kenai into a port city. Canning companies were established and helped fuel the commercial fishing boom that was the primary activity through the 1920s.

In 1940, homesteads were opened in the area. In 1947, after World War II, the United States government withdrew a number of townships along Cook Inlet and the lower Kenai River from the Kenai National Moose Range, opening up the area to settlement under the Homestead Act. After World War II, veterans were given priority in homesteading in this area and settlement began to grow

In 1937, construction of the Kenai Airport began. The first dirt road from Anchorage was constructed in 1951; pavement would not arrive until 1956 with the construction of the Kenai Spur highway.

Oil was discovered at the nearby Swanson River area in 1957, this was the first major oil discovery in Alaska. In 1965, offshore oil discoveries in Cook Inlet caused a period of rapid growth giving the population and economy of the area another major boost. In 1964, the Kenai Peninsula Borough government, and the Kenai Peninsula Borough School District were formed.

According to the KPB web page, the Borough currently has one of the state's most diverse economies. Major industries include oil and gas, commercial fishing, tourism and logging. The oil and gas industry is composed of exploration, extraction, storage, processing/manufacturing, and transportation, and accounts for approximately one-third of the labor force. Commercial harvest and processing of fish in the borough traditionally includes: salmon, halibut, crab, shrimp, clams, scallops, herring, and various ground fish. Tourism is the fastest growing industry in the borough and the Kenai Peninsula Tourism Marketing Council enjoys widespread membership. The timber

industry is an emerging part of the local economy with an automated lumber mill on the eastern peninsula and a large chipping operation located on the southern peninsula.

## 3.2 General Geology

The geology of the Kenai Spur Highway to the north of MP 13 is dominated by end moraines of the Killey Stade that advanced from the west. Glacial moraine features start about MP 17 and continue to the end of the existing road. Between MP 17 and 28 the highway crosses pitted outwash laid down during various advances of the Killey. South of MP 17 the highway crosses a "braidplain" of the Killey Stade (Reger, et. al., 2007). The braidplain in this instance is a glaciofluvial outwash plain that exhibits a braided pattern on aerial photos. The material in the braidplain becomes coarser as you go north, starting out as a fine to medium sand in the Kenai River bluff in the City of Kenai.

## 3.3 Material Sites

Geology of the Kenai Spur Highway to the north of MP 13 is dominated by the end moraines of the Killey glaciation overlain by glaciofluvial deposits of sand and gravel. All the active DOT&PF material sites are found on the pitted outwash. Many of the inactive sites were also on the outwash with some also falling on the braidplain. Two sample results in the outwash gave Los Angeles Abrasion losses ranging from 13 to 15, degradation values from 60 to 80, and coarse NOSO4 losses of zero, and fine NOSO4 losses of 3. The results, while limited, indicate that the material may produce crushed aggregates, including D-1 and asphalt aggregate.

## 4.0 LAND USE PLANNING

State lands along the Kenai Spur Highway are being managed by the State of Alaska Department of Natural Resources (DNR) under the Kenai Area Plan.

The Kenai Area Plan was adopted in 2001. The Kenai Area Plan manages state uplands, tidelands, and submerged lands within the planning boundary. This area includes the majority of the Kenai Peninsula, bounded on the north by Turnagain Arm, where plan boundaries contact boundaries of the Turnagain Arm Management Plan and the Susitna Area Plan. The Plan is bounded to the east by Prince William Sound Area Plan. The Kenai Area Plan area includes some state lands on the west side of Cook Inlet, where it contacts the Bristol Bay Area Plan.

The complete plan is available on the internet at the following address:

http://dnr.alaska.gov/mlw/planning/areaplans/kenai/

The following excerpts from the plan are directly relevant to material sources.

Pursuant to *Alaska Department of Natural Resources, Division of Mining, Land & Water, Planning, Area Plan, Kenai Area Plan, Chapter 2 (adopted January 7, 2000)* is as follows:

**Goals**

The following goals are for state lands in the planning area. Goals are general conditions that DNR attempts to achieve through management actions. The goals are listed alphabetically. No single goal has a priority over the others.

**Economic Development.** Provide opportunities for jobs and income by managing state land and resources to support a vital, self-sustaining local economy.

**Fiscal Costs.** Minimize the needs for and the fiscal cost of providing government services and facilities, such as schools and roads. Locate settlement uses where there is a sustainable economic base and where necessary services can be efficiently provided.

**Public Health and Safety.** Maintain or enhance public health and safety for users of state land and resources.

**Public Use.** Provide and enhance diverse opportunities for public use of state lands, including uses such as hunting, fishing, boating, and other types of recreation.

**Quality of Life.** Maintain or enhance the quality and diversity of the natural environment, including air, land and water, and fish and wildlife habitat and harvest opportunities; and protect heritage resources and the character and lifestyle of the community.

**Settlement.** Provide opportunities for private ownership and leasing of land currently owned by the state.

**Sustained Yield.** Maintain the long-term productivity and quality of renewable resources and all other state-owned replenish able resources on a sustained-yield or optimum-sustained-yield basis, including fish, wildlife, rangelands and forests.

**Management Intent**

Management intent for state land is based on a resource and use inventory, information on existing and potential trends, current and pending authorizations, plans in place now, and public participation. The planning process included a consideration of alternatives. Public and agency comments on these alternatives and the 1994 draft plan were analyzed. In addition, considerable additional research was conducted on each parcel between 1994 and 1998. The planning team discussed this information in 1998 and extensive changes to the 1994 draft were made including an extensive reformatting of the plan and its policies, guidelines, and management intents. The public and agencies again reviewed these changes in late 1999 and early 2000. In response, DNR made additional changes to the plan prior to its adoption.

**General Framework of the Plan**

A. State land within the planning area will be managed to allow for multiple use unless legislatively designated or a parcel of state land is less than 640 acres and managed under a management agreement by another state agency.

B. State land will also be managed to protect access (except when it is determined that access may be detrimental to a resource, such as brown bears) and public resources.

Types of resources to be protected include, but are not limited to, habitat, recreation, water quality, watersheds, scenery, wilderness, and trails.

C. State land will remain open to mineral entry unless specifically closed.

D. Activities and authorizations identified in units as "designated uses" may take precedence over other uses that are authorized subsequent to designation. Although some uses are designated, other uses may still be allowed in a given unit. These other uses may be authorized if they are not incompatible with the primary uses or resources for which a unit is designated. This plan emphasizes minimizing land use conflicts through plan guidelines and intent rather than through prohibitions. However, if DNR determines that a proposed use is incompatible with the designated use, the proposed use shall not be authorized or it shall be modified so that the incompatibility no longer exists.

E. This plan designates state lands in categories that are generally consistent with current use patterns and the most significant resources in the planning area.

**Guidelines by Activity or Resource Value**

The following guidelines are specific directives that will be applied to management decisions.

DNR will use these guidelines when considering issuing authorizations and conveyances or making management decisions on state land. These guidelines will also apply to lands that are currently state selected and topfiled when they are tentatively approved or patented into state ownership.

Chapter 2 guidelines apply to all state land covered by the Kenai Area Plan unless the plan explicitly exempts units or designations from a guideline or the resource or use for which a guideline is intended does not exist in the unit in question.

**General**

A. All authorizations for use of state land within the planning area will be consistent with the management intent in this plan.

B. In considering authorizations for use of state land, DNR will adjudicate applications to:

1. minimize damage to streambeds, fish and wildlife habitat, vegetation, trails, and other resources;

2. minimize conflicts between resources and uses; and

3. protect the long-term value of the resource, public safety, and the environment.

C. If authorizations from other agencies are required, DNR will consider issuing a permit or lease contingent upon issuance of these other authorizations.

**Other State Land**

Parcels that are donated or acquired after the plan is adopted will be designated for the uses for which they were acquired or donated without an amendment to the plan. Lands that come into state ownership through other means will be classified after consultation with ADFG.

Also pursuant to *Alaska Department of Natural Resources, Division of Mining, Land & Water, Planning, Area Plan, Kenai Area Plan, Chapter 2-32: Materials (adopted January 7, 2000),* reads as follows:

**MATERIALS**

**Goals**

**Land for state-owned materials sites.** Maintain suitably located material sites in state ownership and make them available to public and private users to economically meet the area's long-term need for materials. Many of these sites are already owned by the Department of Transportation and Public Facilities or managed by them under Interagency Land Management Assignments issued by DNR.

**Management Guidelines**

**A. Materials Land Management.** On land designated Materials, the priority is to manage the unit to allow exploration and development of sand, gravel, and other materials. Developing material sites is a high priority.

**B. Materials Site List.** The units designated Materials in this plan do not encompass all lands with materials potential owned by DNR and DOT&PF. Materials designations are based on information that was available at the time the plan was developed. As more information becomes available, new sites may be identified and may be re-designated Materials through a "Minor Change" to the plan consistent with 11 AAC 55.030.

**C. Applications for Uses of Material Land.** DOT&PF will be consulted when reviewing applications on lands that are identified as containing materials in this plan. Materials sites that are still needed by DOT&PF for materials extraction, materials storage, public facilities, and other transportation-related uses will be retained in state ownership.

**D. Activities in Wetlands.** DNR may authorize materials removal and other activities in wetlands, including construction of roads and pads, if DNR determines that the proposed ac-

tivity will not cause significant adverse impacts to important fish and wildlife habitat or important ecological processes, a feasible and prudent alternative does not exist, and it is in the state's best interest.

Materials removal from wetlands, lakes, or stream corridors (including active and inactive floodplains) should occur only after design consultation with the Department of Fish and Game, the Department of Environmental Conservation, and the Kenai Peninsula Borough. A Title 16 Permit may be required from ADFG in fish-bearing waters. Dredging and filling activities require a U.S. Army Corps of Engineers Section 404 Permit.

**E. Maintain Other Uses and Resources**. Before materials are extracted, DNR will ensure that requirements of the material sale contract adequately protect other important resources and uses, such as existing water rights, water resource quantity and quality, navigation, fish and wildlife habitat and harvest, commercial forest resources, recreation resources and uses, heritage resources, adjacent land uses, scenic resources, and access to public or private lands.

DNR should determine if other existing material sites could be vacated and rehabilitated as a result of opening a new material site. The disposal of materials should be consistent with the applicable management intent statement for the unit and management guidelines in the plan.

**F. Land Offerings in Areas of High Materials Potential**. Generally, if a unit is designated Settlement but contains sand and gravel deposits, rock sources, or other similar, high-value materials resources, a pit area will be identified and retained in public ownership for future use before lands are offered for sale.

**G. Screening Materials Sites.** Material sites will, where feasible and prudent, be screened from roads, residential areas, recreational areas, and other areas of significant human use. Sufficient land will, where feasible and prudent, be allocated to the materials site to allow for such screening.

**Resource Allocation Summary**

Regional and local demand for materials is high on the Kenai Peninsula because of the extensive road network. Acre-for-acre, material sites are some of the highest value land the state owns in the planning area. In areas where materials are not located on state lands, costs for publicly funded projects can increase dramatically because of the cost of shipping or purchase from nonstate sources. Even though this plan designates 28 sites Materials (approximately 1,300 acres), there is a limited supply of materials on state land. As a result, with few exceptions, all known materials sites are designated Materials and are to be managed for this and related transportation uses. Exceptions are units where DOT&PF has determined that the site is no longer needed. In one instance, an entire river, the Resurrection, includes management intent to allow for extraction not only for construction projects, but also to reduce danger of flooding. For some sites the plan recommends future use of the site such as conveyance to a municipality or for a future community or commercial center. Some of the units that are not already under DOT&PF management are recommended for it. See Chapter 4, Table 4.8 for a list of these sites.

**From Chapter 4**
**Table 4.8 Proposed Interagency Land Management Assignments (ILMA's) with other State Agencies**

| Unit # | Region | Name of Unit | Acreage | Agency |
|---|---|---|---|---|
| **106G** | **6** | **Crooked Creek State Fish Hatchery** | **10** | **ADFG** |
| **68C** | **7** | **Materials site on Sterling Hwy adjacent to Deep Creek Knoll** | **1** | **DOT&PF** |
| 117C | 6 | Materials site at junction of E. Cohoe Loop & Edmonds Roads | 37 | DOT&PF |
| 118 | 6 | K. Beach Rd. Mile 8-10, four parcels | 44 | DOT&PF |
| 133 | 5 | Gravel pits, Sterling Hwy Mile 86.7 | 80 | DOT&PF |
| 188 | 9 | Gray Cliff north of Seldovia | 12 | DOT&PF |
| 192 | 9 | Port Graham airstrip | 31 | DOT&PF |
| 227 | 7 | Homer DOT&PF Maintenance Facility | 5 | DOT&PF |
| 241 | 7 | DOT&PF misc. use site on Old Sterling Hwy. SE of Anchor Point | 80 | DOT&PF |
| 253A | 7 | Materials source at Mi 162 Sterling Hwy. 5 miles S. of Anchor | 10 | DOT&PF |
| 276B | 8 | Upper Swift Creek materials site, end of Eagle Lake Road | 40 | DOT&PF |
| 284 | 1 | Sunrise South - east side of Hope Highway | 34 | ADFG |
| 291 | 1 | Bear Creek Materials Site, Hope | 60 | DOT&PF |
| 323 | 7 | DOTPF site south of Happy Valley Road junction on Sterling | 40 | DOT&PF |
| 357 | 3 | Spur Ridge west of Lowell Point; former rock quarry | 252 | DOT&PF |
| 380B | 2 | North end Lawing Airstrip; existing material site | 46 | DOT&PF |
| 382G | 2 | Lawing Airstrip, S. of Crown Point on Seward Highway | 21 | DOT&PF |
| 399 | 4 | DOTPF materials site at Quartz Creek airstrip | 22 | DOT&PF |
| 408A | 4 | Potential material site at Mi 40 Sterling Hwy. 200' north of | 87 | DOT&PF |
| 409A | 4 | Upper Quartz Creek materials site | 43 | DOT&PF |
| 410A | 2 | Canyon Creek materials site at Mi. 48.5 of Seward Hwy. on | 5 | DOT&PF |
| 410B | 2 | Lower Summit Lake materials site | 17 | DOT&PF |
| | | **Total** | **977** | |

## 5.0 RELEVANT PUBLICATIONS

The following is a list of publications that may be useful for understanding the geology and material sources in the Kenai Spur Highway area. (Note: references pertaining specifically to the Kenai Quadrangles appear under the quadrangle listing; references including these quadrangles plus other portions of the greater area appear in the "alignment-wide" or "statewide" sections).

### Kenai B-4, C-3 and C-4

Reger, R.D., Sturmann, A.G., Berg, E.E., and Burns, P.A.C., 2007, A guide to the late Quaternary history of northern and western Kenai Peninsula, Alaska: Alaska Division of Geological & Geophysical Surveys Guidebook 8, 112 p., 6 sheets, scale 1:63,360. doi:10.14509/15941

### Alignment-wide (Sterling Highway)

Karlstrom, T.N.V., 1964, Quaternary geology of the Kenai Lowland and glacial history of the Cook Inlet region, Alaska: U.S. Geological Survey Professional Paper 443, 69 p., 7 sheets, scale 1:63,360.

Martin, G.C., Johnson, B.L., and Grant, U.S., 1915, Geology and mineral resources of Kenai Peninsula, Alaska: U.S. Geological Survey Bulletin 587, 243 p., 4 sheets, scale 1:62,500.Péwé, T.L., 1975, Quaternary geology of Alaska: U.S. Geological Survey Professional Paper 835, 145 p., 3 plates.

Wilson, F.H., Hults, C.P., Labay, K.A., and Shew, Nora, 2008, Preliminary integrated geologic map databases for the United States: digital data for the reconnaissance geologic map for Prince William Sound and the Kenai Peninsula, Alaska: U.S. Geological Survey Open-File Report 2008-1002.

Wilson, F.H., Hults, C.P., Schmoll, H.R., Haeussler, P.J., Schmidt, J.M., Yehle, L.A., and Labay, K.A., 2012, Geologic map of the Cook Inlet region, Alaska, including parts of the Talkeetna, Talkeetna Mountains, Tyonek, Anchorage, Lake Clark, Kenai, Seward, Iliamna, Seldovia, Mount Katmai, and Afognak: U.S. Geological Survey Scientific Investigations Map 3153, 76 p., 2 sheets, scale 1:250,000.

### Statewide

Brown, J., Ferrians, O. J., Heginbottom, J. A., and Melnikov, E. S., 1997, Circum-Arctic map of permafrost and ground-ice conditions: U.S. Geological Survey Circum-Pacific Map, 1map, scale 1:10,000,000.

Coulter, H. W., Hopkins, D. M., Karlstrom, T. N. V., Péwé, T. L., Wahrhaftig, C., and Williams, J. R., 1965, Map showing extent of glaciations in Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-415, 1 map, scale 1:2,500,000.

Ferrians, O. J. (comp.), 1965, Permafrost map of Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-445, 1 map, scale 1:2,500,000.

Gallant, A. L., Binnian, E. F., Omernik, J. M., and Shasby, M. B., 1995, Ecoregions of Alaska: U.S. Geological Survey Professional Paper Report Number 1567, 73 p. 1 map, scale1:5,000,000.

Hamilton, T.D., Reed K.M., Thorson, R.M., 1986, Glaciation in Alaska, the geologic record. Alaska Geological Society, p. 265.

Jones, D.L., Silberling, N. J., Berg, H. C., and Packer, G., 1981, Map showing tectonostratigraphic terranes of Alaska, columnar sections, and summary description of terranes: U.S. Geological Survey Open File Report 81-792, 21 p., 1 sheet.

Karlstrom, T.N.V., et al., 1964, Surficial geology of Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-357, scale 1:584,000.

Nokleberg, W.J., Plafker, George, and Wilson, F.H., 1994, Geology of south-central Alaska, in Plafker, George, and Berg, H.C., ed., The Geology of Alaska: Geological Society of America, p. 311-364.

Péwé, T.L., 1975, Quaternary geology of Alaska: U.S. Geological Survey Professional Paper 835, 145 p., 3 plates.

Plafker, George, Moore, J.C., and Winkler, G.R., 1994, Geology of the southern Alaska margin, in Plafker, George, and Berg, H.C., ed., The Geology of Alaska: Geological Society of America, p. 389-448.

Reger, R.D., 1987, Survey of the sand-and-gravel potential of mental health grant lands in Alaska: Alaska Division of Geological & Geophysical Surveys Public Data File 87-28, 156 p., 84 sheets, scale 1:63,360.

Reger, R.D., 1987, Survey of the sand-and-gravel potential of legislatively designated replacement pool lands in Alaska: Alaska Division of Geological & Geophysical Surveys Public Data File 88-2, 18 p., 227 sheets, scale 1:63,360.

Reger, R.D., 1988, Status of geologic data for active material sites on mental health grant (trust) lands in Alaska: Alaska Division of Geological & Geophysical Surveys Public Data File 88-20, 54 p., 23 sheets, scale 1:63,360.

Reger, R.D., Combellick, R.A., Brigham-Grette, J., 1995, Late-Wisconsin events in the Upper Cook Inlet region, Southcentral Alaska. In: Combellick, R.A., Tannian, F. (Eds.), Short Notes on Alaska Geology 1995: Professional Report 117. Alaska Division of Geological & Geophysical Surveys, pp. 33-45.

Schmoll, H.,R., Yehle, L.,A., Gardner, C., A., Odum, J.,O.,1984, Guide to Surficial Geology and Glacial Stratigraphy in the Upper Cook Inlet Basin. Alaska Geological Society, p. 89.